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Psychopathological Mechanisms Linking Childhood Traumatic Experiences to Risk of Psychotic Symptoms: Analysis of a Large, Representative Population-Based Sample

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Background: **Different psychological models of trauma-induced psychosis have been postulated, often based on the observation of "specific" associations between particular types of childhood trauma (CT) and particular psychotic symptoms or the co-occurrence of delusions and hallucinations. However, the actual specificity of these associations remains to be tested.** ***Methods:*** **In 2 population-based studies with comparable methodology (Netherlands Mental Health Survey and Incidence Study-1 [NEMESIS-1] and NEMESIS-2, $N = 13\,722$), trained interviewers assessed CT, psychotic symptoms, and other psychopathology. Specificity of associations was assessed with mixed-effects regression models with multiple outcomes, a statistical method suitable to examine specificity of associations in case of multiple correlated outcomes.** ***Results:*** **Associations with CT were strong and significant across the entire range of psychotic symptoms, without evidence for specificity in the relationship between particular trauma variables and particular psychotic experiences (PEs). Abuse and neglect were both associated with PEs (OR_{abuse}: 2.12, $P < .001$; $OR_{neglect}$: 1.96, $P < .001$), with no large or significant difference in effect size. Intention-to-harm experiences showed stronger associations with psychosis than CT without intent ($\chi^2 = 58.62$, $P < .001$). Most trauma variables increased the likelihood of co-occurrence of delusions and hallucinations rather than either symptom in isolation.** ***Discussion:*** **Intention to harm is the key component linking childhood traumatic experiences to psychosis, most likely characterized by co-occurrence of hallucinations and delusions, indicating buildup of psychotic intensification, rather than specific psychotic symptoms in isolation. No evidence was found to support psychological theories regarding specific associations between particular types of CT and particular psychotic symptoms.**

Key words: epidemiology/childhood adversity/psychosis

Introduction

Childhood trauma (CT) has been studied extensively as a risk factor for psychosis.[1] In a comprehensive meta-analysis, a positive association with an overall OR of 2.78 was found.[1] However, knowledge of possible underlying mechanisms is still limited. Several authors, in an attempt to interpret epidemiological data, have postulated different psychological theories linking childhood traumatic experiences to later development of psychosis.

For example, it has been proposed that CT results in posttraumatic reactions later in life, expressed as hallucinations.[2] A related theory is that delusions may be a cognitive effort to make sense of hallucinatory experiences,[3] which may be more likely to occur in individuals who have experienced CT, as a study in a large sample of adolescents and young adults recently found that co-occurrence of hallucinations and delusions, compared to occurrence of either symptom in isolation, was more likely in individuals exposed to trauma.[4]

In addition to studies examining differences in the phenotypic expression of psychosis associated with CT, a number of studies have focused on the possible influence of the type of trauma experienced, using subdivisions of CT, ie, abuse and neglect.[5,6] These studies reported stronger associations of abuse and psychosis, compared with neglect.[5,6] Other

authors focused on the possible influence of particular traumatic experiences on specific psychotic symptoms such as auditory verbal hallucinations (AVH) and paranoia,[7] based on the hypothesis that sexual abuse may specifically impair source monitoring, thus inducing AVH, whereas growing up outside a family setting (ie, foster care) may impact on attachment styles, thus predisposing to paranoia.[7]

Lastly, some studies examined whether the intentional nature of the traumatic experience is an important factor, in agreement with the "social defeat" theory of psychosis.[8] These studies suggested that the possible effect of accidents during childhood, compared to childhood maltreatment, may be smaller.[9]

A hitherto neglected point is that examination of the question whether particular trauma variables are specifically associated with particular types of psychotic symptoms requires the use of specialized statistical models. The observation of greater effect sizes of particular trauma variables on particular psychotic symptoms,[4–7] or the finding of a significant association with one type of trauma but not another,[5,9] does not necessarily imply that there is a "specific" association that validates a specific etiopathogenic model.[10] In fact, the examination of possible specificity of associations in case of multiple correlated outcomes (such as hallucinations and delusions) requires the use of specific mixed-effects regression models with multiple outcomes, which have not been used previously.[10]

The aim of the present study was to investigate epidemiological evidence underlying the aforementioned psychological theories linking trauma and psychotic experiences (PEs), using mixed-effects regression models with multiple outcomes where applicable, in a combined sample of Dutch individuals from the general population (N = 13 722), consisting of 2 population-based samples with comparable methodology (Netherlands Mental Health Survey and Incidence Study-1 [NEMESIS-1], N = 7076 and NEMESIS-2, N = 6646).

Methods

This study is part of the first and second NEMESIS (NEMESIS-1 and NEMESIS-2)—2 longitudinal studies on the prevalence and incidence of psychiatric disorders in the Dutch general population. Both studies were approved by a medical ethics committee, and respondents provided written informed consent. The participants were interviewed at home by trained interviewers, who were not clinicians, with the Composite International Diagnostic Interview (CIDI) version 1.1[11] (NEMESIS-1) and 3.0[12] (NEMESIS-2) and additional questionnaires. A more detailed description of NEMESIS-1[13] and NEMESIS-2[14] is presented elsewhere.

Childhood Trauma

CT was assessed using a questionnaire developed for NEMESIS-1[13]. Whenever a subject reported having experienced one of 4 types of CT (emotional neglect [ignored or unsupported], physical abuse [kicked, hit, bitten or hurt], psychological abuse [yelled at, insulted or threatened], and sexual abuse [any unwanted sexual experience]) before the age of 16, they were asked to state how often it had occurred, on a scale of 1 (once) to 5 (very often). As these trauma scales loaded strongly onto one factor (eigenvalue: 2.56), an overall trauma score was made by adding the scores of each trauma type (range: 0–20). Furthermore, subjects were asked about upbringing in a foster family, and whether during childhood, a parent, sibling, or close friend had died. As these trauma variables were binary, they were not included in the total trauma score.

Psychosis

Studies with earlier versions of the CIDI concluded that the instrument provides a reliable and valid assessment of mental disorders, with the exception of psychotic disorders.[15] Thus, a psychosis add-on instrument was constructed, based on the section of psychotic symptoms in CIDI version 1.1. This part of the interview consisted of questions regarding 20 lifetime PEs, each rated "yes" or "no" (see van Nierop et al[16] for a detailed description).

Individuals who endorsed at least one lifetime PE were contacted for reinterview over the telephone by an experienced clinician. Reinterviews were conducted using questions from the Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (SCID-I), an instrument with proven reliability and validity.[17] Self-reported PEs were considered present when the subject reported a PE at the first (lay) interview; validated PEs were considered present if the self-reported PEs were confirmed at the follow-up interview. In NEMESIS-2, all self-reported PEs were followed up for validation.[16] In NEMESIS-1, the lay interviewers scored each (self-reported) PE on a scale of 1–6: "1," no symptom; "2," PE present but not clinically relevant; "3," PE result of drug use; "4," PE result of somatic disease; "5," true PE; and "6," possible plausible explanation for what appears to be a PE. Each participant with a score of either 2, 5, or 6 score was followed up for validation.[18]

Depression and Cannabis

Consistent with earlier work in NEMESIS-1[19] and other CIDI-based population work,[20] a lifetime depression score was obtained by adding the ratings of the 28 symptom items (present/not present) from the CIDI 1.1 or 3.0 Depression section. Cannabis use was assessed in the section Illegal Substance Use of the CIDI 1.1 or CIDI 3.0. Conform previous work in NEMESIS, "cannabis use," was defined as use of cannabis a least once in the lifetime.[21]

Sample and Prevalences

The NEMESIS-1 sample consisted of 7076 participants (response rate: 70%), see Bijl et al[13] and online supplementary table 1 for characteristics. Of the 479 participants eligible for reinterview, 226 participants (47%) were interviewed. The NEMESIS-2 sample consisted of 6646 participants (response rate: 65%; see online supplementary table 1 for characteristics). Of the 1078 participants eligible for reinterview, 792 participants were interviewed (74%).

Analyses

All analyses were performed using Stata, version 11[22]. Each type of analysis was first performed in the full sample (NEMESIS-1 and NEMESIS-2 combined) using self-reported PEs as a measure of psychosis. However, because self-report of psychotic symptoms is known to yield "false positives,"[16] additional sensitivity analyses were conducted in the subsample with confirmed interview-based PEs. In order to avoid issues concerning differences in methodology between NEMESIS-1 and NEMESIS-2 with regard to the validation of self-reported PEs, for the sensitivity analyses, validated PEs were taken from the NEMESIS-2 sample only. Furthermore, given the amount of multiple, related hypotheses involved, the threshold of statistical significance was set at $P < .001$. A priori confounders included in all analyses were depression,[23] cannabis use,[24] age, and gender.

Hallucinations, Delusions, AVH, and Paranoia. Associations between all trauma variables and occurrence of any hallucinations, delusions, AVH (hearing voices), or paranoia (persecutory ideation, fear of being spied on, secretly being tested on, or being the victim of a conspiracy) were first established using logistic regression with hallucinations, delusions, AVH, or paranoia as dependent variables. Regression analyses were carried out for each type of symptom and type of trauma separately.

In order to examine whether CT increases the likelihood of hallucinations and delusions co-occurring together, multinomial logistic regression was applied using type and combination of PEs (no PEs [reference group], isolated hallucinations, isolated delusions, or combination of hallucinations and delusions) as the dependent variable. Then, associations of trauma with a combination of symptoms vs isolated symptoms was assessed using post hoc analyses by Wald test.[25] A sensitivity analysis in the NEMESIS-2 subsample was impossible due to small group sizes (online supplementary table 1).

Specificity of Associations Between "Type of Trauma" and Either Hallucinations or Delusions, and AVH or Paranoia. Analyses examined whether any of the trauma variables had a stronger association with either hallucinations or delusions, by performing a mixed-effects logistic regression model (XTMELOGIT command in Stata). The multilevel models used for the analyses allow for a proper test for differences in how trauma impacts on hallucinations and delusions. In other words, instead of analyzing the impact of trauma on each symptom separately (which would only indicate whether trauma is or is not significantly related to each symptom), this method tests whether the impact of trauma differs significantly for hallucinations or delusions. This approach is, therefore, preferable in the same sense that subgroup analyses in clinical trials should be conducted by testing proper interaction terms instead of analyzing subgroups separately.[10] Assessment of specificity of trauma for AVH or paranoia was done using the same analysis, now with presence of AVH or paranoia as outcomes.

A (simplified) mathematical equation for this model can be found in online supplementary box 1.

Abuse, Neglect, and Intention to Harm. In order to investigate whether abuse or neglect have differential associations with psychosis, logistic regression analyses were applied. Presence of any PE was the dependent variable, and abuse (psychological, sexual, or physical abuse) or neglect (emotional neglect) were dichotomous independent variables. As these analyses include only one outcome, mixed-effects analyses were not necessary. The difference of influence of abuse and neglect was thus established by post hoc Wald test.[25] A similar analysis was performed to investigate whether CT with an intention to harm (psychological, sexual, or physical abuse) or trauma without intent (death of a parent, sibling, or close friend) have differential associations with psychosis.

Results

Prevalence Rates

The prevalence of at least one self-reported lifetime PE in both datasets combined was 17% (2359 of 13 615 participants) or 18% in NEMESIS-1 (1278 of 7076) and 16% in NEMESIS-2 (1084 of 6646). The prevalence of at least one validated PE in NEMESIS-2 was 6% (384 of 6357).

Hallucinations and Delusions. Associations with traumatic experiences were significant across the entire range of PEs, except for death of a loved one, and these results were largely confirmed in the sensitivity analysis (table 1). However, none of the trauma variables showed a significantly stronger association (at $P < .001$) with delusions than with hallucinations, either in the full sample or in the sensitivity analysis (table 2).

Moreover, emotional neglect and psychological abuse were more strongly associated with the co-occurrence of hallucinations and delusions than with isolated hallucinations (table 3). In addition, a trend for a stronger association with co-occurring hallucinations and delusions compared with isolated hallucinations was also found for physical ($\chi^2 = 3.65$, degrees of freedom [*df*] = 1, $P = .0562$) and sexual abuse ($\chi^2 = 5.25$, $df = 1$, $P = .0220$). Similarly,

Table 1. NEMESIS-1 and NEMESIS-2 Baseline Measurement: Effect Sizes of Each Type of Trauma and Hallucinations, Delusions, Auditory-Verbal Hallucinations, and Paranoia (Self-reported and Validated by Reinterview [Sensitivity Analysis])

	Hallucinations (Self-report)		Hallucinations (Interview[a])		Delusions (Self-report)		Delusions (Interview)		AVH[b] (Self-report)		AVH (Interview)		Paranoia (Self-report)		Paranoia (Interview)	
Continuous Trauma Scales (Standardized)	OR[c] (95% CI[d])	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*
Total trauma[e]	**1.39 (1.32–1.46)**	**.000**	**1.36 (1.23–1.50)**	**.000**	**1.35 (1.29–1.41)**	**.000**	**1.43 (1.30–1.57)**	**.000**	**1.42 (1.30–1.55)**	**.000**	1.30 (1.10–1.54)	.002	**1.34 (1.28–1.41)**	**.000**	**1.46 (1.30–1.65)**	**.000**
Emotional neglect[f]	**1.30 (1.23–1.37)**	**.000**	**1.32 (1.19–1.47)**	**.000**	**1.31 (1.25–1.37)**	**.000**	**1.40 (1.27–1.54)**	**.000**	**1.38 (1.25–1.53)**	**.000**	1.26 (1.05–1.51)	.012	**1.29 (1.22–1.35)**	**.000**	**1.37 (1.21–1.56)**	**.000**
Psychological abuse[f]	**1.34 (1.27–1.41)**	**.000**	**1.28 (1.15–1.43)**	**.000**	**1.28 (1.23)**	**.000**	**1.34 (1.22–1.49)**	**.000**	**1.34 (1.22–1.48)**	**.000**	1.21 (1.00–0.47)	.052	**1.29 (1.23–1.35)**	**.000**	**1.38 (1.21–1.58)**	**.000**
Physical abuse[f]	**1.25 (1.20–1.31)**	**.000**	**1.27 (1.15–1.39)**	**.000**	**1.20 (1.15–1.25)**	**.000**	**1.26 (1.15–1.38)**	**.000**	**1.25 (1.16–1.36)**	**.000**	1.24 (1.05–1.45)	.009	**1.20 (1.15–1.25)**	**.000**	**1.27 (1.13–1.43)**	**.000**
Sexual abuse[f]	**1.22 (1.17–1.28)**	**.000**	**1.22 (1.11–1.33)**	**.000**	**1.16 (1.12–1.21)**	**.000**	**1.20 (1.10–1.31)**	**.000**	**1.28 (1.20–1.38)**	**.000**	**1.26 (1.10–1.44)**	**.001**	**1.17 (1.12–1.23)**	**.000**	**1.27 (1.14–1.42)**	**.000**
Growing up in foster care[g]	**2.11 (1.45–3.07)**	**.000**	1.80 (0.70–4.64)	.221	**1.80 (1.29–2.52)**	**.001**	2.12 (0.87–5.15)	.097	2.44 (1.21–4.92)	.013	2.31 (0.54–9.84)	.258	1.74 (1.19–2.54)	.004	3.27 (1.25–8.52)	.015
Death of parent, sibling or friend[g]	1.00 (0.83–1.19)	.976	0.77 (0.47–1.28)	.316	1.21 (1.05–1.39)	.008	0.98 (0.65–1.48)	.925	1.47 (1.04–2.08)	.029	0.61 (0.24–1.54)	.295	1.20 (1.02–1.40)	.028	1.01 (0.57–1.80)	.959

Note: NEMESIS, Netherlands Mental Health Survey and Incidence Study. All effect sizes were obtained by separate regression analyses; a priori confounders added are depression, cannabis use, age, and gender. Only the effect sizes in bold are considered significant, set at the more stringent level of .001.

[a]Interview-based validation of psychotic symptoms (NEMESIS-2 subsample)—sensitivity analysis.

[b]Auditory-Verbal Hallucinations.

[c]OR.

[d]95% CI.

[e]Overall trauma score (combination of emotional neglect, psychological abuse, physical abuse, and sexual abuse) range: 0–20; thus, ORs linear trend.

[f]Trauma score range: 0 (never) to 5 (very often); thus ORs linear trend.

[g]Binary trauma variable.

Table 2. NEMESIS-1 and NEMESIS-2 Baseline Assessment: Associations (at $P < .001$) of All Trauma Types and Hallucinations vs Delusions and Auditory-Verbal Hallucinations vs Paranoia (Self-reported and Validated by Reinterview Sensitivity Analysis)

	Hallucinations vs Delusion (Self-report)		Hallucinations vs Delusions (Interview[a])		AVH[b] vs Paranoia (Self-report)		AVH vs Paranoia (Interview)	
	OR[c] (CI[d])	*P* Value	OR[c] (CI)	*P* Value	OR[e] (CI)	*P* Value	OR[e] (CI)	*P* Value
Emotional neglect	1.13 (1.01–1.26)	.028	1.12 (0.85–1.48)	.426	0.98 (0.82–1.16)	.804	1.16 (0.79–1.70)	.445
Psychological abuse	0.93 (0.84–1.05)	.242	1.08 (0.79–1.48)	.612	1.08 (0.90–1.30)	.390	1.23 (0.80–1.88)	.335
Physical abuse	0.95 (0.87–1.04)	.304	0.91 (0.71–1.17)	.483	0.97 (0.84–1.12)	.662	0.84 (0.61–1.19)	.333
Sexual abuse	0.93 (0.86–1.00)	.064	0.93 (0.76–1.14)	.489	0.91 (0.83–1.02)	.096	1.04 (0.81–1.34)	.770
Growing up in foster care	0.78 (0.42–1.45)	.432	1.07 (0.14–8.25)	.943	0.89 (0.34–2.34)	.810	3.06 (0.13–72.24)	.487
Death of a parent, sibling, or close friend	1.36 (1.03–1.79)	.027	1.65 (0.70–3.90)	.250	0.84 (0.54–1.28)	.419	1.65 (0.43–6.30)	.465

Note: Abbreviations are explained in the first footnote to table 1.
Each coefficient expresses the differential influence of trauma on either hallucinations vs delusions or AVH vs paranoia. A priori confounders added are depression, cannabis use, age, and gender. All trauma variables were added simultaneously to the model. Significance is set at more stringent level of .001.
[a]Interview-based validation of psychotic symptoms (NEMESIS-2 subsample)—sensitivity analysis.
[b]Auditory-Verbal Hallucinations.
[c]OR >1 indicates stronger association with delusions; OR <1 indicates stronger association with hallucinations.
[d]95% CI.
[e]OR >1 indicates stronger association with paranoia; OR <1 indicates stronger association with AVH.

emotional neglect, psychological abuse, physical abuse, and sexual abuse were all more strongly associated with a co-occurrence of hallucinations and delusions, compared with isolated delusions (table 3). Growing up in foster care and death of a loved one were not associated more strongly with co-occurrence of hallucinations and delusions compared with isolated hallucinations ($\chi^2_{foster} = 0.24$, $df = 1$, $P = .626$; $\chi^2_{death} = 0.85$, $df = 1$, $P = .357$) or isolated delusions ($\chi^2_{foster} = 0.10$, $df = 1$, $P = .754$; $\chi^2_{death} = 0.42$, $df = 1$, $P = .518$).

AVH and Paranoia. Results from the separate regression analyses are shown in table 1. None of trauma variables had a specific or significantly stronger association with AVH or with paranoia, in either the full sample or in the sensitivity analysis (table 2).

Abuse, Neglect, and Intention to Harm. In the full sample, abuse (OR: 2.12, CI: 1.92–2.35, $P < .001$) and neglect (OR: 1.96, CI: 1.76–2.17, $P < .001$) were both associated with self-reported PEs. Post hoc analysis showed that the effect of one was not larger than the other ($\chi^2 = 2.77$, $df = 1$, $P = .0961$). Similarly, in the sensitivity analysis, both abuse (OR: 2.19, CI: 1.74–2.75, $P < .001$) and neglect (OR: 2.49, CI: 1.94–3.20, $P < .001$) were associated with psychosis, however of equivalent effect size ($\chi^2 = 0.21$, $df = 1$, $P = .646$).

Individuals reporting CT with intention to harm had an increased likelihood of reporting self-reported PEs (OR: 2.12, CI: 1.92–2.35, $P < .001$). This was also true for individuals reporting CT without intention to harm, although at much lower effect size and at trend-level significance (OR: 1.14, CI: 1.00–1.29, $P = .047$). Post hoc analysis showed that the association between trauma with intention to harm and psychosis was significantly stronger ($\chi^2 = 58.62$, $df = 1$, $P < .001$).

Comparable results were found in the sensitivity analysis, in that trauma with intention to harm was associated with validated PEs (OR: 2.19, CI: 1.74–2.75, $P < .001$), whereas trauma without intention to harm was not (OR: 0.88, CI: 0.61–1.28, $P = .512$). Postestimation analysis confirmed that the association between trauma with intention to harm and psychosis was significantly stronger ($\chi^2 = 16.91$, $df = 1$, $P < .001$).

Discussion

This study confirms earlier findings of associations between CT on the one hand, and hallucinations and delusions on the other.[2,5–7] Most types of CT were associated with an increased probability of co-occurrence of hallucinations and delusions, rather than their isolated occurrence, in agreement with previous findings.[4]

No evidence was found for specificity of any of the trauma variables for any of the psychotic symptoms, except for trauma with or without "intention to harm." Trauma with "intention to harm" showed a stronger association with PEs, compared to trauma without "intention to harm."

Social Defeat, Intention-to-Harm Experiences, and Psychosis

The finding that the experience of "intention to harm" is a key factor in the association between CT and psychosis

Table 3. NEMESIS-1 and NEMESIS-2 Baseline Assessment: Associations (at $P < .001$) of All Trauma Types and Self-reported Isolated Hallucinations, Isolated Delusions, and Combination of Hallucinations and Delusions

	Total Trauma[a]	Emotional Neglect[b]	Psychological Abuse[b]	Physical Abuse[b]	Sexual Abuse[b]	Growing Up in Foster Care[c]	Death of Parent, Sibling, or Friend[c]
	OR Linear Trend (CI[d])	OR Linear Trend (CI)	OR Linear Trend (CI)	OR Linear Trend (CI)	OR Linear Trend (CI)	OR (CI)	OR (CI)
No psychotic symptoms[e]	1	1	1	1	1	1	1
Isolated hallucinations	1.34* (1.25–1.44)	1.22* (1.14–1.32)	1.29* (1.21–1.39)	1.24* (1.16–1.33)	1.20* (1.12–1.27)	2.51* (1.57–4.02)	0.96 (0.75–1.22)
Isolated delusions	1.29* (1.23–1.37)	1.26* (1.20–1.33)	1.23* (1.17–1.30)	1.17* (1.11–1.23)	1.11* (1.06–1.18)	1.92* (1.30–2.82)	1.24 (1.06–1.45)
Hallucinations and delusions	1.59* (1.49–1.70)[f,g]	1.50* (1.39–1.61)[f,g]	1.50* (1.40–1.60)[f,g]	1.34* (1.26–1.43)[g]	1.30* (1.23–1.38)[g]	2.12 (1.21–3.72)	1.13 (0.87–1.45)

Note: NEMESIS, Netherlands Mental Health Survey and Incidence Study. All effect sizes were obtained by separate regression analyses; a priori confounders added are depression, cannabis use, age, and gender.

[a]Overall trauma score (combination of emotional neglect, psychological abuse, physical abuse, and sexual abuse) range: 0–20; thus, ORs linear trend.

[b]Trauma score range: 0 (never) to 5 (very often); thus, ORs linear trend.

[c]Binary trauma variable.

[d]95% CI.

[e]Reference group.

[f]χ^2 co-occurrence of hallucinations and delusions >isolated hallucinations, $P < .001$.

[g]χ^2 co-occurrence of hallucinations and delusions >isolated delusions, $P < .001$.

*$P < .001$ (significance is set at more stringent level of .001).

may fit with the "social defeat hypothesis of psychosis,"[8] which postulates that several environmental risk factors for psychosis, including CT, may increase feelings of outsider status, which in turn is associated with psychosis.[26] However, one could argue that the loss of a parent may also result in an outsider status in children, as afterwards peers may have difficulty including them in social activities. As this type of trauma showed a weaker association with psychosis in the present study, this would suggest that not feelings of social defeat itself, but perceived social threat, especially present in bullying or other types of abuse, could be the key risk factor for psychosis, in agreement with previous work.[9]

Co-occurrence of Hallucinations and Delusions

The present study found evidence for an increased probability of co-occurrence of hallucinations and delusions associated with CT. Previous work has reported similar results, including an increased risk of this co-occurrence associated with other known environmental risk factors for psychosis, such as cannabis use and urbanicity,[4,27] indicating higher levels of etiological loading in individuals reporting both symptoms. Furthermore, co-occurrence of these symptoms has been shown to be associated with an increase in help seeking and greater severity of symptoms.[4] Therefore, the data suggest that CT increases risk for intensification of the psychotic process, causing buildup from simple to more complex psychotic states that increase the risk for help seeking and, finally, clinical decompensation.

Specificity in the Association Between CT and Psychosis

Other than differences in associations with psychosis when assessing the presence of "intention to harm," no other evidence of specificity, in terms of trauma variables or symptoms, was found. Even though the theory that childhood abuse leads to source monitoring deficits, resulting in hallucinations, may be appealing,[7] it does not exclude the possibility that negative views about the world and others may arise, which have been suggested to fuel delusions.[28]

Furthermore, as the present findings indicate that all trauma variables, including sexual abuse and growing up in foster care, did not show statistically dissimilar associations with paranoia and AVH, assumptions about specific psychological processes following these trauma variables may not apply.[7]

Statistical Methods

The present results underscore the importance of using mixed-effects logistic regression models for assessing specificity in effects of trauma on symptoms. For example, in this sample, physical abuse showed a significant association with paranoia and no significant association with AVH. By using mixed-effects logistic regression, it was revealed that these effect sizes were not statistically different, in contrast to what previous work had suggested.[7] Similarly, by statistically comparing the effect sizes of abuse and neglect, it was shown that neither abuse nor neglect showed a stronger association with psychosis, again not confirming previous interpretations.[5,6]

Strengths and Weaknesses

To the best of our knowledge, this is the first study including such a wide array of aspects regarding the association between CT and psychosis, using a large representative sample of the Dutch population. In addition, the quality of the psychological assessments was high, as self-reported PEs were reassessed by clinical interview (by an experienced rater with clinical experience), thus decreasing the possibility of false positives. An important limitation of this study lies in its cross-sectional nature, with lifetime assessment of symptoms (precluding inferences on chronological order of trauma and symptoms), abolishing any claims of causality. Furthermore, because CT was assessed using retrospective reports, recall bias may have influenced these results, although other studies have found that recall of CT is reliable, even in individuals with presence of psychosis.[29]

Supplementary Material

Supplementary material is available at http://schizophreniabulletin.oxfordjournals.org.

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